

UNITED STATES DISTRICT COURT
DISTRICT OF MINNESOTA

In re: BAIR HUGGER FORCED AIR
WARMING PRODUCTS LIABILITY
LITIGATION

MDL No. 15-2666 (JNE/FLN)

This Document Relates To:
All Cases

**PLAINTIFFS' MEMORANDUM OF LAW IN SUPPORT OF MOTION TO
EXCLUDE OPINIONS AND TESTIMONY OF JOHN ABRAHAM, PHD**

TABLE OF CONTENTS

I.	Introduction And Factual Background.....	2
II.	Legal Standards.....	8
III.	Argument	11
A.	Abraham's CFD Results Are Not Relevant To The Facts Of This Case.....	11
B.	Abraham's CFD Analysis Should Be Excluded Because His Lack Of Pertinent Disclosure And Deletion Of Files Prohibits Meaningful Evaluation	14
C.	Abraham's Experiments Are Not Sufficiently Reliable To Support His Proposed Testimony.....	18
D.	Abraham's Testimony Regarding Publications Should be Limited	20
1.	Testimony Outside of Abraham's Areas of Expertise	20
a)	Abraham Lacks The Expertise To Evaluate The Risk Of Surgical Site Infection.....	21
b)	Abraham Lacks The Expertise To Evaluate Whether Warming Technologies Are An Important Part Of Surgical Patient Care	21
c)	Abraham's Claim Dr. Elghobashi's Analysis Was Completed At The Direction Of A Business Competitor	21
2.	Criticism Of "Heat-Rises.Blogspot.Com" Is Not Rebuttal	22
IV.	Conclusion.....	22

TABLE OF AUTHORITIES

Cases

<i>Daubert v. Merrell Dow Pharmaceuticals, Inc.</i> , 509 U.S. 579 (1993).....	passim
<i>Flomerics, Ltd. v. Fluid Dynamics Int'l, Inc.</i> , 880 F.Supp. 60 (D.Mass. 1995).....	10
<i>Gen. Elec. Co. v. Joiner</i> , 522 U.S. 136 (1997).....	9
<i>Glastetter v. Novartis</i> , 107 F. Supp. 2d 1015 (E.D. Mo. 2000)	11
<i>Groobert v. President and Directors of Georgetown College</i> , 219 F. Supp. 2d 1 (D.D.C. 2002).....	9
<i>Holverson v. ThyssenKrupp Elevator Corp.</i> , CIV. 12-2765 ADM/FLN, 2014 WL 3573630.....	11
<i>In re Baycol Prods. Litig.</i> , 532 F. Supp. 2d 1029 (D.Minn. 2007).....	9
<i>Kumho Tire Co., Ltd. v. Carmichael</i> , 526 U.S. 137 (1999).....	8, 9
<i>Liquid Dynamics Corp. v. Vaughan Co.</i> , 449 F.3d 1209 (Fed. Cir. 2006)	10
<i>Marmo v. Tyson Fresh Meats, Inc.</i> , 457 F.3d 749 (8 th Cir. 2006)	22
<i>Polski v. Quigley Corp.</i> , 538 F.3d 836 (8th Cir. 2008)	8, 9
<i>Quiet Tech. DC-8, Inc. v. Hurel-Dubois UK Ltd.</i> , 326 F.3d 1333 (11 th Cir. 2003)	10, 14
<i>Select Comfort Corp. v. Tempur Sealy Int'l, Inc.</i> , 14-cv-00245 (JNE-JSM)(Doc. 202)	7
<i>Wheeling Pitts. Steel v. Beelman River Terminals</i> , 254 F. 3d 706 (8th Cir. 1999)	20
<i>Wilmington v. J.I. Case Co.</i> , 793 F.2d 909 (8th Cir. 1986)	11

Other Authorities

<i>Gene J. Heady, Comment, Stuck Inside These Four Walls: Recognition of Sick Building Syndrome Has Laid the Foundation to Raise Toxic Tort Litigation to New Heights</i> , 26 Tex. Tech L.Rev. 1041, 1060–61 (1995).....	10
<i>Lewis D. Solomon & Suzanne E. Schoch, Developing Critical Technologies: A Legal and Policy Analysis</i> , 9 Santa Clara Computer & High Tech. L.J. 153, 179–80 (1993)	10

Rules

Federal Rule of Evidence 702	2, 7, 11
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Plaintiffs move to exclude the opinions and testimony of John Abraham, Ph.D. who has disclosed expert opinions on heat transfer and air flow in operating rooms. Ex. A, Report of John Abraham (“Abraham Rpt”).

Abraham’s proposed testimony does not fit the facts of this case. Abraham disclosed one computational fluid dynamics (“CFD”) simulation of operating room streamlines¹. But this is not a case about streamlines. Plaintiffs did not suffer burns or thermal injuries or the like. This litigation is about patients who suffered infections caused by airborne particles laden with bacteria. Specifically, this case is about Defendants’ Bair Hugger Forced Air Warming system (“Bair Hugger”) device being the most likely cause of moving those bacteria-laden airborne particles to cause the surgical site infections.

Plaintiffs’ experts have demonstrated that the Bair Hugger significantly disrupts the unidirectional airflow of an operating room, and open surgical wounds are exposed to particles that can carry bacteria. Yet, Abraham did not analyze the movement of particles in such an environment. He merely tried to simulate the streamlines—the instantaneous velocity of air at a given point in time.² Streamlines are not the same as particle movement and are not a scientifically-valid proxy for movement of the kind of particles

¹ A “streamline” is a line in the fluid whose tangent is everywhere parallel to the local velocity vector instantaneously.

² Abraham’s video lasts about 2 minutes, but it is actually a snapshot in time of the instantaneous velocity after the Bair Hugger was turned on for 1.2 seconds. Ex. B, Deposition of John Abraham (“Abraham Dep.”) at 239:17.

at issue in this case. As such, Abraham's proposed testimony cannot "help the trier of fact to understand the evidence or to determine a fact in issue" and should therefore be excluded.

It is not surprising that Abraham's CFD did not include particles, because Abraham admitted in deposition that he is not an expert in particle flow. Abraham Dep. 246:3-8. Despite this being a case about infections caused by airborne particles that carry bacteria in the OR, his report is almost entirely devoid of discussion of particle flows—the few exceptions arise in Abraham's criticisms of literature.

In addition to its misdirected focus, Abraham failed to produce the data by which his CFD results can be evaluated and therefore cannot meet the reliability standards of Federal Rule of Evidence 702. Abraham failed to indicate which engineering equations he used and what conditions he set. While testing the parameters of an expert's opinions are generally fodder for cross examination and not exclusion, when a technical expert attempts to offer an opinion which is utterly lacking in testability, the Court has an obligation to exercise the gate-keeping function outlined by *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993). Abraham's opinions and testimony should be rejected as unreliable and of no assistance to the trier of fact.

I. INTRODUCTION AND FACTUAL BACKGROUND

On March 31, 2017, Plaintiffs disclosed the Rule 26 report of Said Elghobashi, M.Sc., Ph.D., D.Sc., a highly-respected, world-class expert on, among other things, particle flow calculations in turbulent flows, to offer expert opinions and testimony on issues of general causation. Ex. C (Elghobashi CV). Elghobashi conducted a large eddy

simulation (“LES”)³ study comparing two simulated operating room conductions. In the first, Bair Hugger is not running. As expected, the unidirectional air flow of the operating room keeps particles away from the surgical site. In the second, Bair Hugger is running. Without changing any other variables, the study showed that the convection currents generated by the Bair Hugger carried particles to the area over the surgical table, to the instrument table, operating table, and to the surgical site. Elghobashi’s CFD shows that extensive particle movement took less than 30 seconds after the operating room reached steady state. Thus, Dr. Elghobashi’s study concludes that when the hot air blower is turned on, the Bair Hugger disrupts the air flow above and below the operating table (“OT”) significantly. Ex. D, Expert Report of Said Elghobashi (Elghobashi Rpt) at 2. Elghobashi’s LES simulation demonstrates a “statistically significant [number of] particles [...travel to...] the operating table and the patient’s knee.” *Id.* at p. 62, l. 822-824. Elghobashi based his opinions on a recognized approach to evaluating particle movement in turbulent flow.⁴

On June 2, 2017, Defendants disclosed the expert report of John Abraham, Ph.D., an engineer specializing in heat transfer. Ex. A. Abraham’s disclosure was purportedly offered to rebut Elghobashi’s general causation opinion. But in fact, Abraham’s CFD

³ Ex. D, at p. 6, l. 105-110 (“Large-eddy simulation (LES) is a numerical technique that involves computing the properties of the large, energy-containing eddies of turbulence accurately, without any user adjustable tuning parameters, and models only the more homogenous, small scales of turbulence. This technique provides the instantaneous three-dimensional velocity, temperature, and pressure fields and has been shown to be far more accurate than the [Reynolds-averaged Navier Stokes (“RANS”)] model.”)(citations omitted).

⁴ As discussed below, courts have recognized CFD is a reliable methodology.

simulation was prepared long before Dr. Elghobashi's disclosure was served. Abraham Dep. 24:12-17.

Dr. Elghobashi's report contains all the information and facts needed for someone in a similar scientific field to reproduce the study's results. Even more importantly, Dr. Elghobashi's report can be reviewed, analyzed, and criticized by others in the field because he described his methodology. In stark contrast, Abraham's report does not contain any methodology he used so that one in his field (or similar) could determine (much less reproduce) the method utilized to achieve the results.

The absence of methodological support for Abraham's analysis is highlighted by comparing Abraham's report to the detailed disclosure made by Dr. Elghobashi. Dr. Elghobashi provided all the mathematical equations used in his CFD simulation, Abraham did not. Abraham Dep. 64:12-15. Dr. Elghobashi provided calculations for the boundary conditions used in his CFD simulation, Abraham did not. Abraham Dep. 164:7-17. Dr. Elghobashi provided the data results for the entire simulation of 27 seconds, Abraham produced only a single result for a single moment in time. Abraham Dep. 47:5-7. Abraham manually deleted the files for all of the other results.⁵ Abraham Dep. 52:20-51:23. Dr. Elghobashi provided the initial conditions for his CFD simulation, Abraham deleted the computer file with the initial conditions. *Id.*

⁵ Abraham completed his model during the Walton litigation in December 2015, hence, before the beginning of discovery. Abraham Dep. 25:1-6 Abraham, who is not a stranger to providing expert services in litigation, destroyed all the relevant files required for the Plaintiffs' to reproduce or analyze his methodology.

Some of these shortcomings are exacerbated by Abraham's decisions about what to exclude from his simulation. For example, Dr. Elghobashi calculated and modeled the heat and air coming from under the operating room table, Abraham cannot verify the geometry used for the air coming out of the Bair Hugger. Abraham Dep. 273:8-20. The Bair Hugger mass flow in Abraham's report cannot be reproduced. Abraham Dep. 315:22-24. Dr. Elghobashi created his own geometry, but Abraham does not know who created the geometry. Abraham Dep. 37:17-20. Abraham cannot verify the accuracy of the surgical drapes used in his model. Abraham Dep. 272:12-22.

Dr. Elghobashi used actual solids and materials in his model, Abraham did not. Abraham Dep. 140:9-141:6. Abraham's model did not contain the specific heat properties of the drapes, the surgical table, or any other objects in the operating room. *Id.* As a result, the heat released by the Bair Hugger did not transfer to the solid objects like the drapes, the surgical table, or below the surgical table. Abraham Dep. 142:20-22. Dr. Elghobashi used people in his model, Abraham admitted that people in the operating room would affect the airflow and yet he omitted them from his model. Abraham Dep. 138:12-16; 221:1-2. Dr. Elghobashi included the Bair Hugger blower in his model, Abraham did not even though he conceded that the Bair Hugger blower would affect the airflow in the operating room. Abraham Dep. 221:3-9.

Abraham admitted one needs the initial conditions to reproduce his results, those conditions are part of the methodology. Abraham Dep. 71:9-13; 253:14-254:5. Abraham destroyed the file containing initial conditions. Abraham Dep. 52:20-51:23. The time step, which is the time between individual simulation "frames," is required to reproduce

the results. Abraham Dep. 68:3-5; 71:9-17. Although the time step is important (Abraham Dep. 67:15-20), Abraham does not know the time step he used. Abraham Dep. 51:23-25. He may have changed it at some time during the simulation. Abraham Dep. 65:21-66:7.

Other aspects of Abraham's report are false and/or misleading. For example, the "grid cells"⁶ described on page 4 of Abraham's report may not be the mesh used in the CFD analysis he seeks to present to the jury. Abraham Dep. 171:11-17. Abraham describes the mesh as "up to 60,000,000 grid cells" in one instance and 8.1 million cells in another, neither of which match the roughly 9.8 million grid cells on the single data file Abraham provided to Plaintiffs. (Abraham Report at 4, 5).⁷

Despite omitting even a single reference to either initial conditions and/or any equations establishing the analysis in his own report, Abraham seeks to dispute Elghobashi's methodology report by attacking both the boundary conditions and the validation of the computational fluid dynamics ("CFD") modeling software employed by Elghobashi. This attempted double standard is equivalent to the flip-flop Abraham made in sequential depositions in another recent case before this Court, wherein Abraham took

⁶ Grid cells, or "mesh," refers to the three-dimensional shapes (e.g., cubes, pyramids, etc) in which CFD software performs calculations. Just like pixels on a TV, higher mesh count provides a higher resolution, but because the number of calculations is greater, a higher mesh model generally takes more processing power or time. For complex simulations, computers may require weeks or months of run time to produce a simulation result.

⁷ Dr. Abraham testified that he conducted more than one CFD simulation, one with an 8.1 million grid cells and the other with up to 60,000,000 grid cells. (Abraham Dep. 172:21). Abraham produced only one set of data points representing one instant in time in one simulation out of the hundreds of sets that were created from those two CFD simulations. Abraham testified that he deleted all but the one file provided to the Plaintiffs which contained the mesh of 9,884,667 cells. (*Id.* at 321:13).

one position with respect to an infringement issue, and flip-flopped to take the opposite position when it came to the invalidity portion of the case.⁸ Because Abraham's opinions are fundamentally unsupported, they must be excluded.

Although the Supreme Court has construed Rule 702 in favor of admitting expert testimony, there are limits. The proponent of the testimony, whether plaintiff or defendant, has the burden of establishing that the expert's testimony is based on a reliable methodology. *Daubert*, 509 U.S. at 592. Outright exclusion of an expert is reserved for those unusual cases where there can be no reasonable dispute that an expert's analysis is fatally flawed. Failure to show the reliability of each step in an expert's methodology is fatal under Rule 702 and *Daubert*.

Defendants cannot meet their burden of showing that Abraham's testimony is reliable and relevant to the disputes in this case. Methodological errors and speculation permeate Abraham's opinions at every step. His unique methodology—to the extent a methodology exists—is first to impugn Elghobashi's reputation by baselessly accusing a Member of the National Academy of Engineering⁹ of failing to understand basic principles of physics, then to cobble together colored illustrations purporting to reflect an

⁸ *Select Comfort Corp. v. Tempur Sealy Int'l, Inc.*, 14-cv-00245 (JNE-JSM)(Doc. 202).

⁹ The National Academy of Engineering (NAE) is part of the National Academies of Sciences, Engineering, and Medicine, which was signed into law by Abraham Lincoln in 1863. “Election to membership is one of the highest professional honors accorded an engineer. [...] Individuals can not apply for membership in NAE...The procedures for nomination and election of member and foreign member candidates involve a search in all fields of engineering by present members of the NAE for outstanding individuals with identifiable contributions...” See <https://www.nae.edu/About/BecomingaMember.aspx>. Fewer than 4,200 engineers across the globe have been extended an invitation to join. See <https://www.nae.edu/MembersSection/MemberDirectory.aspx> (last visited September 5, 2017). Dr. Elghobashi was elected as a member in 2014.

“independent” CFD analysis, all while refusing to disclose either the initial conditions upon which the model is based, the calculations Abraham claims to have performed, or the methods by which these calculations were performed.

Abraham’s approach falls short of the reliability standard set forth in *Daubert* and Federal Rules of Evidence 702. As described in more detail below, Abraham’s testimony should be excluded.

II. LEGAL STANDARDS

Federal Rule of Evidence 702 permits expert testimony if the subject of the testimony is relevant, the witness is qualified to express the opinions, and the proposed evidence upon which the witness bases the testimony is reliable or trustworthy. *Polski v. Quigley Corp.*, 538 F.3d 836, 839 (8th Cir. 2008); *see also Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137, 141 (1999) (requiring courts to “ensur[e] that an expert’s testimony both rests on a reliable foundation and is relevant to the task at hand”).

Courts are the gatekeeper of evidence proffered under Rule 702, “to make certain that an expert, whether basing testimony upon professional studies or personal experience, employs the same level of intellectual rigor that characterizes the practice of an expert in the relevant field.” *Kumho Tire*, 526 U.S. at 152.

Expert testimony must be trustworthy for it to be reliable. *Daubert*, 509 U.S. at 590. Four nonexclusive factors control the reliability of expert testimony: “(1) whether the theory or technique can be and has been tested; (2) whether the technique has been subject to peer review and publication; (3) the technique’s known or potential rate of

error; and (4) the level of the theory or technique's acceptance within the relevant discipline." *Id.* at 593-94.

The Eighth Circuit considers additional factors as well, including: "whether the expertise was developed for litigation or naturally flowed from the expert's research; whether the proposed expert ruled out other alternative explanations; and whether the proposed expert sufficiently connected the proposed testimony with the facts of the case. *Polski*, 538 F.3d at 839. The party seeking admission of expert testimony has the burden of demonstrating its reliability. *In re Baycol Prods. Litig.*, 532 F. Supp. 2d 1029, 1042 (D. Minn. 2007), *see also Daubert*, 509 U.S. at 592.

Where the factual basis, data, or the methodology employed by the expert are sufficiently called into question, the court must determine not only if the testimony is reliable, but also whether it has a valid connection to the pertinent inquiry. *Kumho Tire*, 526 U.S. at 149. Expert testimony must therefore "logically advance[] a material aspect of the proposing party's case." *Daubert*, 509 U.S. at 597.

Likewise, the court should not admit opinion evidence "that is connected to existing data only by the *ipse dixit* of the expert," *Gen. Elec. Co. v. Joiner*, 522 U.S. 136, 157 (1997), or that is based on his own methodology rather than a respected methodology. *Groobert v. President and Directors of Georgetown College*, 219 F. Supp. 2d 1, (D.D.C. 2002). Under these circumstances, a court may conclude there is simply too great an analytical gap between the data and the opinion." *Gen. Elec.*, 522 U.S. at 146.

With respect to computational fluid dynamics, many courts have held in the *Daubert* context that the use of CFD software is reliable. *See, e.g., Quiet Tech. DC-8, Inc.*

v. *Hurel-Dubois UK Ltd.*, 326 F.3d 1333, 1343-44 (11th Cir. 2003). “[C]ourts and scholarly commentators alike have recognized, both implicitly and explicitly, the uses and benefits of CFD. See generally, *Liquid Dynamics Corp. v. Vaughan Co.*, 449 F.3d 1209, 1221 (Fed. Cir. 2006) (allowing testimony after finding that CFD is methodologically sound); *Flomerics, Ltd. v. Fluid Dynamics Int'l, Inc.*, 880 F.Supp. 60, 61–63 (D.Mass. 1995) (upholding use of CFD simulation over objections to input parameters). Commentators have described uses for CFD in litigation. See *Gene J. Heady, Comment, Stuck Inside These Four Walls: Recognition of Sick Building Syndrome Has Laid the Foundation to Raise Toxic Tort Litigation to New Heights*, 26 Tex. Tech L.Rev. 1041, 1060–61 (1995) (mentioning various applications for CFD analysis). CFD is used extensively in academia and industrial applications. See *Lewis D. Solomon & Suzanne E. Schoch, Developing Critical Technologies: A Legal and Policy Analysis*, 9 Santa Clara Computer & High Tech. L.J. 153, 179–80 (1993) (noting that the 1990 United States Defense Department's Critical Technologies Plan not only listed CFD as one of the 20 most critical technologies to the prospective development of weapons systems, but listed it in the group of “technologies that were the most pervasive and judged to be of top priority””).

As these cases and others indicate, incorrect CFD inputs and equations do not exclude admissibility of the opinions. *Quiet Tech.*, 326 F.3d at 1343-44. Garbage in, garbage out arguments go to “the weight, not the admissibility, of the evidence [being] offered” *Id.* at 1345. “Vigorous cross-examination of a study's inadequacies allows the jury to appropriately weigh the alleged defects and reduces the possibility of prejudice.”

Daubert, 509 U.S. at 596. “Virtually all the inadequacies in the expert's testimony urged here by [the defendant] were brought out forcefully at trial.... [T]hese matters go to the weight of the expert's testimony rather than to its admissibility.” *Wilmington v. J.I. Case Co.*, 793 F.2d 909, 920 (8th Cir. 1986).

“Under *Daubert*, the ‘testability’ of a theory is critical to its admissibility, as ‘falsifiability, or refutability, or testability’ is necessary to discern valid scientific opinions.” *Holverson v. ThyssenKrupp Elevator Corp.*, CIV. 12-2765 ADM/FLN, 2014 WL 3573630, at *9 (D. Minn. July 18, 2014), citing *Daubert*, 509 U.S. at 593. CFD is an acceptable methodology. However, to discern valid scientific opinions, there should be information to use CFD software to test the proposed testimony. Testability is one of the recognized indicators of whether the expert’s theory is reliable under Rule 702. *Daubert*, 509 U.S. at 593. This method consists of repeating the experiment to determine whether the same result is achievable. No matter which expert is offering it, an opinion based on unsupported speculation is unreliable. See *Glastetter v. Novartis*, 107 F. Supp. 2d 1015, 1045 (E.D. Mo. 2000).

III. ARGUMENT

A. Abraham’s CFD Results Are Not Relevant To The Facts Of This Case

Particle movement at issue in this case and airstreams do not necessarily march to the same tune. Given the nature of this litigation, *i.e.*, whether Bair Hugger causes particles to move through the air such that bacteria on those particles can cause surgical site infections, a CFD simulation without particles cannot possibly help the jury understand the facts of the case. Abraham’s simulation cannot help a jury understand the

movement of particles in an operating room because it simulated only airstreams, not particles. *See Abraham Dep.* 189:13-18.

To be relevant for purposes of 702, expert testimony must be related to the determination of a fact issue. In *Daubert*, the Supreme Court observed scientific validity for one purpose is not necessarily scientific validity for other, unrelated purposes. *Daubert*, 509 U.S. at 591. “Expert testimony which does not relate to any issue in the case is not relevant and, ergo, non-helpful.” *Id.* Here, even if Abraham’s CFD analysis were scientifically valid, the proposed testimony fails the relevancy requirement of Rule 702 because it will not assist the jury in determining whether Bair Hugger causes bacteria-laden particles to move to the surgical site and thereby increases the risk of deep joint infection.

It is incontrovertible that the operating rooms in which the Bair Hugger products operate contain airborne particles. Ex. E, Deposition of Thomas Kuehn (“Kuehn Dep.”) 134:8-135:17; Ex. F, Deposition of 3M 30(b)(6) designee Al Van Duren (“Van Duren Dep.”) 258:1-4. Dr. Wenzel, Defendants’ infectious disease expert, testified that perhaps 40% of operating room particles carry bacteria. Ex. G, Deposition of Richard Wenzel (“Wenzel Dep.”) at 50:2-15. It is beyond question that bacteria carried by those particles can cause periprosthetic joint infections. ***The fundamental question in this case is whether Bair Hugger causes particles to move to the surgical site and thereby increases the risk of deep joint infection.***

When confronted at his deposition, Abraham admitted that the only “particles” in his simulation are molecules of oxygen and nitrogen, *i.e.*, the air in the operating room.

Abraham Dep. 229:1-230:5. Because he modeled only air, Abraham assigned zero mass and zero inertia to the oxygen and nitrogen “particles” in his model. Abraham Dep. 229:15-17.

3M, as the party offering Abraham’s testimony, cannot show that a simulation that excludes particles nevertheless reliably predicts the movement of particles. Abraham, of course, conceded that real particles have mass and have inertia. Abraham Dep. 227:17-228:7. While Abraham testified that he is not an expert in particles in high or low-speed flows, Abraham Dep. 246:3-5, other 3M experts recognized the limitations on modeling particle movement in streamlines. Ex. H, Deposition of Gary Settles (“Settles Dep.”) 90:12-17. Settles did not just admit this under cross examination, but affirmatively stated it in his expert report: “One reason is that particles in an airstream have inertia and therefore do not always follow the streamlines of the flow.” Ex. I, Expert Report of Gary Settles at 1. Dr. Kuehn, a 3M expert, testified that it is theoretically possible to model particle flow in air, but only where the particles are small and the airflow does not change direction quickly. Kuehn Dep. 195:16-25. In particular, Dr. Kuehn testified that the airstream method of predicting particle movement works only when the particles are less than one micron.¹⁰ Kuehn Dep. 195:16-25.

The smallest bacteria at issue in this case is *staph aureus*, which is about 0.9 microns. That reflects the size of the single bacterium, not a colony forming unit (CFU),

¹⁰ Abraham too admitted that the size of a particle impacts whether it follows an airstream, but he could not describe what size particles would follow an airstream and which would not. Abraham Dep. 134:2-19.

and certainly does not account for the particle on which the bacteria are carried through the air. Particles of the size in skin squames do not follow airstreams.

Abraham has no scientific support for his contention that his airflow simulation relates in any way to particle movement. Abraham could have used the CFD software to simulate the movement of particles, but he did not. Abraham Dep. 189:17-18. He instead ran a test without particles and then concluded, without support, that his test represented the worst-case scenario of particle movement. *Id.* at 229:15-19. Abraham did not support that conclusion with references to peer-reviewed literature demonstrating acceptance of his theories in the scientific community, experiments, or otherwise. He merely concluded, *ipse dixit*, that it is so.

By excluding particles such as the ones found in operating rooms, Abraham's study fails to reflect the facts of this case. For that reason, his simulation lacks a sufficient nexus to the disputed issues in this case and should be excluded. To the extent any of Abraham's opinions relied on the simulation, those opinions should likewise be excluded.

B. Abraham's CFD Analysis Should Be Excluded Because His Lack Of Pertinent Disclosure And Deletion Of Files Prohibits Meaningful Evaluation

Plaintiffs are unable to cross examine Abraham's CFD model due to the anemic amount of information that Abraham has provided in his report. Only a single data file exists because Abraham apparently destroyed the rest. With respect to this motion, Plaintiffs' are not challenging the use of the CFD program used by Abraham, or the geometry he created, as such would go to the weight of Abraham's testimony and not to the admissibility. *Quiet Tech. DC-8, Inc.*, 326 F.3d at 1345. Plaintiffs are instead seeking

to exclude Abraham's opinion because the lack of relevant content prevents Plaintiffs' experts from ascertaining the equations used, the initial conditions and data entered, the grid used, and most importantly, whether the results provided were a final solution to the model.

By deleting the relevant files, Abraham made it difficult or impossible to evaluate whether the simulation results are representative of the simulation process. CFD simulations produce snapshots of data at various points in time. Each "time step" might be, for example, and as Abraham suspects he used in this case, 0.1 seconds. In the type of simulation offered by Abraham, it is methodologically necessary that the simulation reach "quasi-equilibrium" before one relies upon the simulation results. Abraham Dep. 223:9-17. Abraham testified that he determined that the simulation reached quasi-equilibrium by visually comparing two of those "snapshots." *Id.* at 235:9.

To reproduce a CFD model, one must indicate the equations used, the initial conditions (Abraham Dep. 71:9), the time step used (*id.* at 68:3), the mesh, and then must determine whether quasi steady state has been reached, *i.e.* whether there is a solution to the equations (*id.* at 251:17). Abraham provided no equations, no initial conditions, no time step, and the mesh described in the text of his report was not the one used in his analysis.

However, under *Daubert*, all of Abraham's opinions which are based off his CFD model should be excluded because Abraham admits that without the initial conditions, the time step, and more than 1 data file, his CFD model cannot be reproduced. See Abraham Dep. 71:9; 68:3; 251:17. Since the Plaintiffs do not have the essential data to

reproduce the results, Abraham's opinions must be excluded because Plaintiffs are precluded from testing the CFD model and thus would be unable to cross-examine Abraham on his results.

Plaintiffs' expert has provided all the information for Defendants to cross-examine his opinions, such is evident based on the criticism of Dr. Elghobashi's by Abraham. As admitted by Abraham:

- Q. Elghobashi provided you calculations of how he did things; correct?
- A. Correct.
- Q. And there are actual equations; correct?
- A. Correct.
- Q. With numbers.
- A. Correct.
- Q. With solutions.
- A. Correct.
- Q. With heat value coefficients; correct?
- A. Correct.
- Q. That you as a -- a -- a person in the field of mechanical engineering can look at it and critique it and determine whether or not it's correct or not; correct?
- A. Correct.

- Q. And that's what you did in this case. You saw what he did and you say, I disagree.
- A. That's right.

Abraham Dep. 365:12-366:5

- Q. Let me ask it simple, simple. In Exhibit 1, 2 or any of the exhibits we saw today that were produced by you, okay, except for the Elghobashi exhibits or any of the citings --
Let's go back. Exhibit 1 and 2 of your report, your CV, as well as your expert report, you agree with me that there is not one mathematical equation that was provided to the plaintiffs in this

case.

A. There is no equation.

Q. So you agree with me. "Yes" or "no"?

A. I agree with you, --

Q. Okay.

A. -- but the information is listed there that would allow someone to reproduce the results.

Q. Okay. You agree with me that there's not one mathematical equation in your expert report; correct?

MR. GOSS: I think he -- I think he answered that.

A. I agree, --

Q. Okay.

A. - and it's not necessary.

Q. And you agree with me there's not one number or -- like equation that uses numbers to show what you did to make any of your assumptions in your expert report; correct?

MR. GOSS: Asked and answered.

A. I agree, I think I've answered that.

Abraham Dep. 366:19-367:22

Abraham criticized Dr. Elghobashi's equations, assumptions, boundary conditions, CFD software, and the actual numbers used in the equations. Abraham therefore made it impossible to determine whether the portions of his simulation highlighted in his report are representative of the simulation results. This substantially limits the scope of the potential cross by plaintiffs. Instead of pointing out actual errors, plaintiffs would be limited to saying, "you don't know" or "you don't remember." Based on the anemic report and destruction of data by Abraham, Plaintiffs are not afforded the opportunity to meaningfully cross Abraham.

In a second related shortcoming, Abraham's data file appears to be for a different simulation than what is depicted in his report. The ".trn" file produced by Abraham

indicated a 9 million cell mesh.¹¹ The mesh is the three dimensional set of polygons—the software runs physics calculations on each polygon to generate the three-dimensional set of data in each snapshot. But Abraham testified that the images contained in his report are from a different simulation, a 60 million mesh simulation. Again, without access to the underlying data, 3M cannot show that Abraham followed accepted methodology in reaching a quasi-equilibrium prior to capturing his simulation results. As the party proffering Abraham's testimony, 3M has the burden to establish that Abraham's testimony was methodologically sound. Because 3M cannot meet that burden, Abraham's CFD opinions should be excluded.

C. Abraham's Experiments Are Not Sufficiently Reliable To Support His Proposed Testimony

Abraham's experiment described briefly on page 10 of his disclosure is not sufficiently reliable to support his proposed testimony. Abraham describes, at a high level, an experiment using visible water vapor into an operating room. But Abraham provided no protocol, detail or documentation by which anyone could determine whether he followed an appropriate methodology. No did Abraham cite to or append any of the pictures or videos of the use of the fog generator to his report. Similar to his CFD analysis, 3M expects that Abraham will just be taken at his word. His testimony

¹¹ ".trn" is a file extension for transient files generated by, for example, the Ansys CFX simulation software used by Abraham to run his airflow simulation. It contains data about the conditions that existed in a single moment in time during the simulation. The file produced by Abraham was 264.trn, indicating that it was the 264th time step in the sequence of steps of this simulation. If the time steps remained equal (and they need not do so), then this would have been approximately 2.64 seconds into the simulation in real-time.

regarding air movement observed during the experiment is not reliable because it is not based on sufficient facts or data. Furthermore, Plaintiffs are unable to meaningfully evaluate the reliability of the experiment through cross-exam because Abraham failed to provide any data in the form of pictures or videos upon which a cross could reasonably be based.

Abraham's methodology, and in particular the choice of fog machines, made it impossible for him to see the water vapor move around the room. This methodological shortcoming is not evident in Abraham's report. It is evident from videos on 3M websites that also depict fog testing and which show the fog dissipating after just a few feet.

That is not surprising. 3M was warned by the fog machine supplier that, depending on turbulence and humidity, the fog might dissipate in just a few feet. *See Ex. J, Abraham Dep. Ex. 10.* Some fog machines allow for 20-30 feet of visibility, but 3M apparently chose not to use one of those machines for this experiment.¹²

Other methods would have likewise provided acceptable visualization of the airflows. For example, Dr. Keuhn testified that a reasonable methodology would be to use neutrally-buoyant helium bubbles. *See Kuehn Dep. 319:5-15.* But Abraham's experiment did not utilize such generally-accepted methodologies. Instead, he used an experimental design that did not allow visualization of the fog for more than a few feet.

¹² *See, e.g.,* <http://www.appliedphysicsusa.com/cleanroom-ultrapure-fogger.html> (describing clean room fogger with 20-30 feet of fog visibility). It would appear that the choice of which fog machine to use was made by 3M's prior outside counsel, Greenberg Traurig, and not by Abraham. *See Ex. J. (Abraham Dep. Ex. 10).* The retailer warned 3M's counsel that the fog might dissipate in as little as 2-3 feet in turbulent air.

Having used a method with a short window of visibility, Abraham nevertheless seeks to testify that the experiment demonstrates the absence of airflows to the surgical site. It is just as likely the fog was no longer visible as that the fog did not reach the surgical site. Because the experimental method does not support the conclusions Abraham seeks to offer regarding air flow, the testimony should be excluded.

D. Abraham's Testimony Regarding Publications Should be Limited

Abraham discloses opinions and conclusions about a host of published papers. First, his opinions regarding papers should be limited to his areas of expertise. Second, Abraham should not be permitted to offer “rebuttal” testimony that is not responsive to plaintiffs’ expert disclosures. Third, to the extent Abraham’s proposed testimony is duplicative of 3M’s other experts, it should be stricken.

1. Testimony Outside of Abraham’s Areas of Expertise

The Court should exclude Abraham’s opinions offered on matters outside of the scope of his expertise. “A witness can be qualified as an expert by ‘knowledge, skill, experience, training, or education,’ Fed. R. Evid. 702, and it is the responsibility of the trial judge to determine whether a particular expert has sufficient specialized knowledge to assist jurors in deciding the specific issues....” *Wheeling Pitts. Steel v. Beelman River Terminals*, 254 F. 3d 706, 715 (8th Cir. 1999). Abraham should not be allowed to testify about matters outside of his area of expertise.

a) Abraham Lacks The Expertise To Evaluate The Risk Of Surgical Site Infection

Abraham should not be allowed to testify about the risk of surgical site infections. He is not an infectious disease expert or an expert in medicine. Abraham Dep. 116:11-16 His report contains a handful of opinions about the impact of Bair Hugger on the risk of surgical site infection, both from his own work and from his review of the literature. But Abraham is not a medical doctor. He is not trained or educated in infectious disease, epidemiology, surgery, biology, or any other field that might reasonably support a claim of expertise to testify about the risk of surgical site infection, much less periprosthetic joint infection. Because he lacks the qualifications, Abraham should not be allowed to testify about whether Bair Hugger increases or decreases the likelihood of surgical site infection.

b) Abraham Lacks The Expertise To Evaluate Whether Warming Technologies Are An Important Part Of Surgical Patient Care

Abraham should not be allowed to testify about whether Bair Hugger or other surgical warming devices are effective and/or “an important part of patient care.” He should not be allowed to testify about whether Bair Hugger prevents hypothermia or improves patient outcomes. Abraham is not a medical doctor. Abraham is simply not qualified to offer those opinions.

c) Abraham’s Claim Dr. Elghobashi’s Analysis Was Completed At The Direction Of A Business Competitor

Bizarrely, Abraham opines that Dr. Elghobashi’s research was conducted at the direction of a business competitor. Abraham Rpt. at 2. Apart from the fact that the claim

is blatantly false, the statement is not reasonably the type of scientific or specialized knowledge about which an expert may typically opine. Moreover, even if the claim were within the realm of “expert” testimony, Abraham lacks any expertise that would allow him to offer that testimony, nor has he offered a basis of any kind for his assertion.

2. Criticism Of “Heat-Rises.Blogspot.Com” Is Not Rebuttal

None of plaintiffs’ experts relied on, commented on, or otherwise incorporated any videos or associated commentary from “heat-rises.blogspot.com.” Rebuttal expert reports “must serve the limited purpose of explaining, repelling, counteracting, or disproving” arguments made by the opposing party’s expert disclosure. *Marmo v. Tyson Fresh Meats, Inc.*, 457 F.3d 749, 759 (8th Cir. 2006).

Abraham’s proposed testimony regarding “heat-rises.blogspot.com” does not “rebut” any aspect of any of plaintiffs’ expert disclosures. It should be stricken as either untimely served under the Court’s scheduling order, or not relevant to the facts in dispute.

IV. CONCLUSION

For the reasons stated above, Plaintiffs ask the Court to Exclude the Deficient Portions of the Testimony of John Abraham, Ph.D.

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